## Description

## Drive roller for a textile machine producing cross-wound bobbins

The invention relates to a drive roller for a textile machine producing cross-wound bobbins according to the preamble of claim 1.

Drive rollers for the frictional drive of a cross-wound bobbin held to rotate in a winding device of a textile machine have been known for a long time. Various embodiments of drive rollers of this type are described in the patent literature.

DE 30 15 207 C1 or DE 100 26 388 A1 describe guide rollers, for example, which consist substantially of a central drive roller body, two laterally arranged, relatively soft drive coverings and two connection elements which can be fixed to the central roller body. The central drive roller body is fixed here in a frictionally engaged or positive manner, on a drive shaft. In other words, all the drive rollers of one machine side are fixed in a rotationally engaged manner on a common drive shaft along the machine, said shaft being connected in turn to a common drive.

This drive form, which has certainly been proven in practice in conjunction with rotor spinning machines, has a few drawbacks, however. During operation of the textile machine, for example, all the drive rollers, at least on one machine side, can always only rotate together and at the same speed. Moreover, the drive coverings of these drive rollers manufactured from a plastics material wear out relatively

quickly. Furthermore, changing these relatively wear-sensitive drive coverings is relatively awkward due to the continuous drive shaft. In other words, the old drive coverings firstly have to be cut open for disassembly before new, slit drive coverings, which also only have a limited service life, can be installed.

However, drive rollers, which are driven by a single motor are also known for winding machines. Drive rollers of this type, known, for example, from DE 43 36 312 C2 are generally configured as thread guide drums, in other words as components which both rotate the cross-wound bobbin and also traverse the thread that is running on. Such thread guide drums generally have a thread-smooth peripheral face, on which the cross-wound bobbin rests with a certain contact pressure and is entrained in a frictionally engaged manner by the driven thread guide drum. As a certain slippage is inevitable in such thread guide drums between the drive roller and cross-wound bobbin, the acceleration capacity of such drive arrangements is limited, in particular when the cross-wound bobbins already have a large diameter and have therefore reached a not insignificant weight.

Furthermore, it is known from DE-PS 593 358, to use drive rollers, the electric motor single drives of which are configured as external rotors, to rotate cross-wound bobbins and to traverse the thread that is running on.

The winding machine shown and described in DE-PS 593 358 shows various embodiments of such thread traversing and cross-wound bobbin drive devices driven by a single motor, with a drive configured as an external rotor. A bearing block, between the

bearing points of which a hollow axle is fastened, is arranged in the region of the winding device of the winding machine in the embodiment according to Fig. 4 of DE-PS 593 358. The stator of an electric drive is fixed to this axle. The axle also forms the counter bearing for the bearing of the drive rotor configured as an external rotor. In this construction, the cross-wound bobbin rests directly on the housing of the external rotor and, during operation, is entrained by the rotating housing of the external rotor in a frictionally engaged manner.

This very compact drive roller also has the disadvantage that, during operation, in particular in acceleration phases, undefined slippage often occurs between the rotor housing, that is designed thread-smooth on its surface, and the cross-wound bobbin, wherein the groove required for thread traversing only reduces the driving surface and accordingly further reduces the friction. "Thread-smooth" in the present case is taken to mean a surface, which is, for example, so polished that it has no edges or corners, on which the thread to be wound on could catch.

In order to drive a cross-wound bobbin with as little slippage as possible, it would be desirable *per se* to provide drive rollers with a relatively rough or a profiled surface, so a positive fit is virtually provided between the drive roller and the cross-wound bobbin.

Drive rollers with a rough surface are ruled out however, as without a thread-smooth surface of these drive rollers, proper traversing of the thread is not possible. Drive rollers with a thread-smooth profiling on their surface have also not

previously been used in practice as the manufacturing methods which were previously conventional in the textile machine industry did not allow the production of drive rollers with a thread-smooth profiling at reasonable costs.

Proceeding from the aforementioned prior art, the invention is based on the object of developing a drive roller with a good service life and high entraining force. In particular, a drive roller is to be provided, which has an economically producible, thread-smooth and stable profiling.

This object is achieved according to the invention with a drive roller, as described in claim 1.

Advantageous configurations of the invention are the subject of the sub-claims.

The embodiment according to the invention has the advantage, in particular, that a thin-walled, abrasion-resistant metal tube can be provided in an economical manner with a thread-smooth profiling by means of high-pressure internal forming and can thus be fixed on the outer periphery of a drive roller, such that the profiling of the drive roller virtually forms a positive fit with the cross-wound bobbin to be driven.

The profiling produced by high-pressure internal forming, of the thin-walled metal tube is thus immediately thread-smooth without any post-treatment.

High pressure internal forming is a production method known *per se* in conjunction with hollow bodies, which allows

relatively economical, reproducible production even of complicated components.

In this method, which is described, for example, in DE 41 03 082 and also known as hydrostatic forming, a hollow body made of a cold-formable metal is placed in the mould cavity of a die and then presseded onto the die wall by means of pressure fluid, which is injected at high pressure. The die wall thus has according to the desired profiling of the tube, hollows, into which the material of the tube is pressed during the forming process with the formation of uniform, smooth radii.

Following the forming process, the thin-walled steel tube immediately has its final, thread-smooth profiling, so further processing steps can be dispensed with. Overall, high-pressure internal forming is a method which makes it possible to produce hollow bodies precisely and economically. In other words, a drive roller can be produced simply and economically by the configuration of a drive roller according to the invention, said drive roller having a long service life and wherein the slippage generally occurring between the drive roller and cross-wound bobbin is minimised.

Steel, preferably an alloy of a so-called high-grade steel, or as stated in claim 3, a coated metal sleeve, has been successful, in particular, as the material for the metal tube. Metal tubes manufactured from such materials are not only corrosion-resistant, but also relatively abrasion-resistant, so profile wear is kept within reasonable limits. In other words, the profiling in metal tubes of this type has a long service life. Moreover, metal tubes of this type are very substantially insensitive to rust.

As shown in claim 4, it is provided in a preferred embodiment that the drive roller is acted upon by an electric motor single drive configured as an external rotor and the thin-walled profiled steel tube is fixed directly to the outer periphery of the rotor housing of the external rotor.

Drive rollers configured in this manner have the advantage, in particular, that the drive rollers only require relatively little installation space owing to their internally located drive, and this is advantageous with respect to the known restricted space conditions at the workstations of a textile machine producing cross-wound bobbins. By using a thin-walled steel tube profiled by high-pressure internal forming, it is moreover possible, to equip the drive rollers economically in such a way that they develop a high entraining force and this has positive effects, in particular when accelerating large cross-wound bobbins.

As the thin-walled, profiled metal tube only has a relatively low weight, the centrifugal mass of the external rotor is only increased insubstantially, in this case.

As stated in claim 5, the wall thickness of the thin-walled metal tube is between 0.1 mm and 0.4 mm, preferably 0.2 mm. Hollow bodies with such a relatively small wall thickness can be processed relatively problem-free by high-pressure internal forming, on the one hand, but, on the other hand, after their profiling and when they have been drawn onto their support body, for example the rotor housing, have the necessary strength.

As stated in claim 6, the profiling of the metal tube is stepped at least in the direction of rotation of the drive roller. In other words, the profiling consists of a large number of nubs or webs arranged spaced apart at least in the direction of rotation. A configuration of this type makes it possible for the profiling of the metal tube to be able to "dig in" slightly into the surface of the cross-wound bobbin resting with a certain contact pressure on the drive roller and to thus virtually form a positive fit with the cross-wound bobbin.

As stated in claim 7, the metal tube may have nubs, for example, in its central region, while webs are incorporated into the side regions of the metal tube. The cross-wound bobbin is thus entrained relatively gently during the spinning operation, via the webs.

In order to wind conical cross-wound bobbins, provision may also be made for the webs to be arranged in the central region of the metal tube (claim 8). Gentle entraining of the conical cross-wound bobbin during the spinning process is also ensured in this case.

According to claim 9, nubs extend uniformly over the entire surface of the steel tube. A configuration of this type also ensures reliable entraining of the abutting cross-wound bobbin to be driven. In other words, owing to the profiling of the metal tube, the slippage between the drive roller and cross-wound bobbin is kept within limits both during uniform operation and in the acceleration or deceleration phases of the winding device.

Reference is made here expressly to the fact that the invention is not limited to the above-described types of profilings of the metal tube, but other types of profiling, for example nubs in the side regions and webs in the central region are certainly also to come under the general concepts of the invention.

The invention will be described in more detail hereinafter with the aid of an embodiment shown in the drawings, in which:

Fig. 1 shows a side view of a half section of a textile machine producing cross-wound bobbins,

Fig. 2 shows a perspective view of a workstation of a textile machine producing cross-wound bobbins,

Fig. 3A shows a drive roller with a first embodiment of a thin-walled steel tube which is profiled by high-pressure internal forming and fixed to the rotor housing of an external rotor,

Fig. 3B shows a drive roller with a further embodiment of a thin-walled steel tube which is profiled by high-pressure internal forming and fixed to the rotor housing of an external rotor,

Fig. 4 shows the drive roller according to the invention with a thin-walled steel tube in section.

Fig. 1 schematically shows a side view of half a textile machine 1 producing cross-wound bobbins, an open end rotor spinning machine in the embodiment.

Textile machines of this type have, as known, a large number of similar workstations 2 between their end frames, not shown. The workstations 2, in each case, have here a spinning unit 3 and a winding device 4. Fibre bands 6, which are stored in spinning cans 5 are processed in the spinning units 3 to form threads 7, which are then wound onto the winding devices 4 to form cross-wound bobbins 8. The finished cross-wound bobbins 8 are conveyed via a cross-wound bobbin conveying mechanism 12 to a loading station (not shown) arranged at the end of the machine.

As indicated in Fig. 1, the workstations 2 also have further handling mechanisms in each case, apart from the spinning unit 3 and the winding device 4, for example a thread draw-off mechanism 10, a suction nozzle 17, a thread store 13 and a waxing mechanism 14. The function of this component is known and described in detail in numerous patents.

As can be seen, in particular, from Fig. 2, the winding device 4 has a deflection roller 15, a thread traversing mechanism 16, with a thread guide 18, a drive roller 11 and a creel 9. The drive roller 11, which is acted upon in the embodiment by a single motor and is not described in more detail in Figs. 3 and 4, in this case drives a cross-wound bobbin 8 that is mounted so as to rotate freely in the creel 9.

As indicated in Fig. 4, the drive roller 11 has an external rotor drive 22, in other words, the stator 25 of an electric motor drive is fixed in a rotationally engaged manner to a bearing axle 24, which is arranged in a rotationally engaged manner, and is connected via power line 26 to a current source

(not shown). Bearing mechanisms 27 for the rotor 23 of the drive roller drive 22, configured as an external rotor, are also positioned on the bearing axle 24. The rotor 23 has a rotor housing 28, on the outer periphery 21 of which is fixed a thin-walled metal tube 19, which is profiled by high-pressure internal forming, preferably a steel tube made of a high-grade steel alloy.

During the winding operation, the thin-walled, profiled steel tube 19 is in contact with the surface of the cross-wound bobbin 8 and entrains it.

The profiling of the thin-walled steel tube 19 consists here, for example, as indicated in Fig. 3A of nubs 20 which are arranged distributed over the entire periphery of the steel tube 19, positioned spaced apart and which "dig in" into the surface of the cross-wound bobbin 8 in a virtually positive manner and therefore ensure that there is always adequate entraining force between the driving drive roller 11 and the driven cross-wound bobbin 8.

In a further advantageous embodiment shown in Fig. 3B, the thin-walled steel tube 19 has regions with different profiling. Webs 30, which are spaced apart in the direction of rotation R of the drive roller, are arranged, for example, in the side regions 32, 33 of the steel tube 19, while a profiling in the form of spaced nubs 20 is present in the central region 31. In a further embodiment (not shown), which is used, in particular, for driving conical cross-wound bobbins, the webs 30 are arranged in the central region of the steel tube 19, while the outer regions are smooth or provided with nubs 20.

As already explained above, the thin-walled steel tube 19 advantageously receives its profiling by means of high-pressure internal forming. In this method, which is known *per se* and described, for example, in DE 41 03 082 A1 and which is also called hydrostatic forming, a hollow body consisting of cold-formable metal is inserted into a die, into which recesses are incorporated, corresponding to the desired profiling. The thin-walled tube is pressed into the recesses present on the inner wall of the die by means of an incompressible medium, preferably a pressure fluid, which is injected at very high pressure into the interior of the hollow body. In other words, the configuration of the inner wall of the die, specifies the final form of the component to be produced with regard to its dimensions or its precise physical configuration.

As relatively smooth radii are produced, in each case, in the region of the bending edges, the finished components already have their final finish, in other words, further post-treatments, such as, for example, deburring, are unnecessary. Even relatively complicated series components can therefore be produced relatively economically and with a very precise fit by high-pressure internal forming.